

In the name of Allah, the Most Gracious, the Most Merciful



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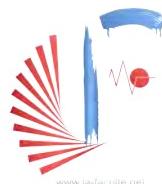
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$$1/ R = 1,5 \quad d = 6000 \text{ A}$$

$$P = \frac{E}{C} \quad E = \frac{hc}{d} \quad P = \frac{hc/d}{c} \quad P = \frac{h}{d}$$

$$P = \frac{6,62 \cdot 10^{-34}}{6000 \cdot 10^{-10}}$$

$$P = 1,103 \cdot 10^{-22} \text{ SI}$$

$$P = 11,03 \cdot 10^{-28} \text{ eV}$$

$$2/ E = \frac{hc}{d} \quad Z = \frac{12400}{d (\text{A})} \quad E = \frac{12400}{6000} \quad E = 2,06 \text{ eV}$$

$$3/ E = h\nu \quad Z = \frac{hc}{\lambda} \rightarrow \nu = \frac{c}{\lambda} \quad \nu = \frac{3 \cdot 10^8}{6000 \cdot 10^{-10}}$$

$$\lambda = 0,5 \cdot 10^{-7} \text{ m} \quad \nu = 5 \cdot 10^{14} \text{ Hz}$$

$$4/ c = 3 \cdot 10^8 \text{ m/s} \quad v = \frac{c}{2} \quad v = \frac{3 \cdot 10^8}{2} \quad v = 1,5 \cdot 10^8 \text{ m/s}$$

$$5/ E_{CA} = 200 \text{ keV} \quad E_{CA} = ev \rightarrow v = \frac{E_{CA}}{e} \quad v = \frac{200 \text{ keV}}{e}$$

$$v = 100 \text{ MeV}$$

$$6/ \phi = \frac{1}{2} [0,5(100 - 80)] \quad \phi = 20 \text{ V}$$

$$7/ f = \frac{\phi}{U_2} \rightarrow z = \frac{\phi}{fU} \quad I = \frac{20}{0,5 \cdot 10^2 \cdot 100 \cdot 10^3}$$

$$I = 40 \cdot 10^{-3} \text{ A} \quad I = 40 \text{ mA}$$

$$8/ E_{CA} = ev \quad E_{CA} = 100 \text{ keV} \quad \frac{E_{CA}}{E_0} = \frac{100}{511} = 0,195 \geq \frac{1}{2}$$

→ e⁻ relativiste

$$E = \frac{E_0}{\sqrt{1 - \beta^2}} \rightarrow \beta = \sqrt{1 - \left(\frac{E_0}{E}\right)^2}$$

$$E = E_0 + E_{CA} \quad E = 511 + 100 \quad E = 611 \text{ keV}$$

$$\rightarrow \beta = 0,548 \rightarrow v = \beta c \quad v = 1,64 \cdot 10^8 \text{ m/s}$$

9/ Rep C

10/ même nombre de protons et même → bre de masse → Rep A

11/ L'énergie maximale des rayons

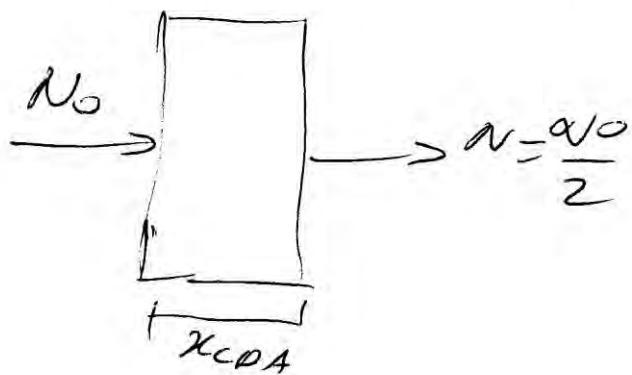
$$E_{max} = ev \quad E_{max} = 80 \text{ keV}$$

12/ $E_{ca} = 3E_{car}$ $E_2 = E_{car} + E_{ca}$ $E_2 = 4E_{car}$

$$E_2 = \frac{E_{car}}{\sqrt{1 - \beta^2}} \quad \beta = \sqrt{1 - \left(\frac{E_{car}}{4E_{car}}\right)^2}$$

$$\beta = 0,968 \rightarrow V = \beta c \rightarrow V = 2,9 \cdot 10^8 \text{ m/s}$$

13/ Rep ④
= 50%



14/ Rep ⑤

15/ Rep ⑥

16/ Rep ⑦

17/ Rep ⑧

18/ Compte . $\rightarrow E \geq 13,6 \text{ eV}$

$$a/ E = h\nu \quad E = \frac{12,4 \cdot 10^{-19}}{1,6 \cdot 10^{-19}} \nu \quad E = 12,4 \cdot 10^5 \text{ eV} > 13,6 \text{ eV} \rightarrow \text{compte}$$

$$b/ z=2 \quad d_m = 0,4 \mu\text{m} \quad \frac{d}{d_m} = n \quad d = 2d_m$$

$$d = 0,8 \mu\text{m}$$

$$E = \frac{12400}{0,8 \cdot 10^{-6} \cdot 10^{10}} \quad E = 1,55 \times 13,6 \text{ nm comteau}$$

$$21) E = h\nu \quad \nu = \frac{c}{\lambda} \quad \text{car } \nu = \frac{1}{\tau}$$

$$E = \frac{662 \cdot 10^{-34}}{10^5 \times 1,6 \cdot 10^{-19}} \quad E = 4,3 \cdot 10^{-10} \text{ eV maximum}$$

22) $d = 0,4 \text{ nm}$ dans le vide

$$E = \frac{12400}{0,4 \cdot 10^9 \times 10^{-10}} \quad E = 3,1 \text{ eV}$$

23) $\nu = \frac{1}{\tau}$ paradoxe - temps ne varie pas

24) $E_T = 950 \text{ MeV} \quad E_{op} = 938 \text{ MeV}$

$$\frac{E_{op}}{E_T} = \frac{938}{950} \quad \frac{E_{op}}{E_T} = 0,98 > \frac{1}{400} \rightarrow \text{relativiste}$$

$$E_T = \frac{E_{op}}{\sqrt{1-\beta^2}} \rightarrow (1-\beta^2) = \left(\frac{E_{op}}{E_T}\right)^2$$

$$\beta = \left[1 - \left(\frac{E_{op}}{E_T} \right)^2 \right]^{1/2} \rightarrow \beta = 0,158$$

$$\beta = \frac{v}{c} \rightarrow v = \beta \cdot c \quad v = 0,158 \times 3 \cdot 10^8$$

$$v = 0,475 \cdot 10^8 \text{ m/s}$$

25) $E_T = 591 \text{ keV} \quad E_T = E_0 + E_{CA} \quad E_0 = 0,511 \text{ MeV}$

$$E_{CA} = E_T - E_0 \quad E_{CA} = 591 - 511$$

$$E_{CA} = 80 \text{ keV}$$

26) $E_{CA} = 80 \text{ keV} > w_L > w_R \dots$

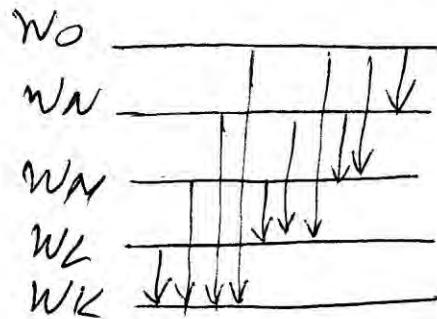
donc tous les niveaux participent aux transferts d'énergie

l'énergie max des rays

$$\text{et } E = W_K - W_0$$

$$E = 69,52 - 0,05$$

$$E = 69,47 \text{ keV}$$



$$24) E = h\nu \quad E = \frac{h}{\tau} \quad E = \frac{6,62 \cdot 10^{-34}}{3,33 \cdot 10^{-19}} \quad E = 1,987 \cdot 10^{-15} \text{ J}$$

$$E = \frac{1,987 \cdot 10^{-15}}{7,6 \cdot 10^{-19}} \quad E = 1,247 \cdot 10^4 \text{ eV} \quad E = 12,47 \text{ keV}$$

$$25) E = \frac{hc}{d} \quad d = \frac{hc}{E} \quad d = \frac{12400}{12,4 \cdot 10^3} \quad d = 14 \text{ cm}$$

$$\frac{d}{d_m} = 2 \rightarrow d_m = \frac{d}{2} \quad d_m = \frac{1}{2,5} \quad d_m = 0,4 \text{ cm}$$

$$26) P = \frac{E}{c} \quad P = \frac{1,987 \cdot 10^{-15}}{3 \cdot 10^8} \quad P = 0,662 \cdot 10^{-23} \frac{\text{JS}}{\text{m}}$$

$$P = 6,62 \cdot 10^{-24} \frac{\text{JS}}{\text{m}}$$

$$27) E_{el} = 12,41 \text{ keV}$$

$$E_{el} = \text{eV} \rightarrow V = \frac{E_{el}}{e} \rightarrow V = 12,41 \text{ kV}$$

$$28) d = \frac{h}{P} \quad P = mv \quad P = m \beta c \times \frac{c}{c}$$

$$P = \beta \frac{E}{c} \rightarrow d = \frac{h}{\beta \frac{E}{c}} \quad d = \frac{hc}{\beta E} \quad \text{m, sorte}$$

$$29) P = \frac{E}{c} \quad P = \frac{h\nu}{c} \quad P = \frac{6,62 \cdot 10^{-34} \cdot 3 \cdot 10^18}{3 \cdot 10^8}$$

$$P = 6,62 \cdot 10^{-24} \text{ SI}$$

30) L'énergie ne dépend pas des nucléus

$$E = h\nu \quad E = \frac{6,62 \cdot 10^{-34} \cdot 3 \cdot 10^{18}}{7,6 \cdot 10^{-19}}$$

31/ $E_T = mc^2$ $E_T = E_0 + E_{C4}$
 avec $E_{C4} = E = 12,41 \text{ keV} \rightarrow E_T = 12,41 + 5711$
 $E_T = 563,41 \text{ keV}$
 $m = \frac{E}{c^2}$ $m = \frac{563,41 \cdot 10^3 \times 1,6 \cdot 10^{-19}}{(3 \cdot 10^8)^2}$ $m = 9,31 \cdot 10^{-31} \text{ kg}$

32/ ~~$E_{C4} = 9,31 \cdot 10^{-31} \text{ kg}$~~

$E_{C4} = 12,41 \text{ keV}$

33/ même vitesse \rightarrow donc même β .

$$E = \frac{E_0}{\sqrt{1 - \beta^2}} \quad (1) \quad E = E_0 + E_C \rightarrow E_C = E - E_0$$

$$E_C = \frac{E_0}{\sqrt{1 - \beta^2}} - E_0 \quad E_C = E_0 \left| \frac{1}{\sqrt{1 - \beta^2}} - 1 \right|$$

$$E_C = E_0 \left[\frac{1}{\sqrt{1 - \beta^2}} - 1 \right] \quad (2)$$

- selon (2) E_C proton est supérieure à E_C de l'électron car $E_{Op} > E_{Oe}$
- $E_{Op} > E_{Oe}$ et $E_{Op} > E_C$ electron
 $E = E_C + E_0$ donc l'énergie totale du proton est supérieure à celle de l'électron
- puis l'énergie cinétique du proton est supérieure à celle de l'électron car E_{Op} est supérieure à E_{Oe} électron \rightarrow donc Rep (2)

34/ $E_{Tp} = E_{Te}$ donc $E_T = E_0 + E_C$

- $E_{Op} > E_{Oe} \rightarrow$ donc il n'ont pas la même
- non il n'ont pas la même vitesse car $E_C \neq E_C$
- $E_T = E_0 + E_C$ $E_{Op} > E_{Oe} \Rightarrow E_{Ce} > E_{Cp}$
 donc l'électron a une plus grande vitesse

Scrite ex 28

$$E = E_0 + E_C \quad E = 511 + 12,41 \quad E = 523,41 \text{ eV}$$

Calcul de β

$$E = \frac{E_0}{\sqrt{1-\beta^2}} \rightarrow (1-\beta^2) = \left(\frac{E_0}{E}\right)^2$$

$$\beta = \sqrt{1 - \left(\frac{E_0}{E}\right)^2} \quad \beta = \sqrt{1 - \left(\frac{511}{523,41}\right)^2}$$

$$\beta = 0,216$$

$$d = \frac{hc}{\beta E} \quad d = \frac{12400 \text{ eV}\cdot\text{\AA}}{0,216 \times 523,41 \times 10^3 \text{ eV}} \quad d = 0,114$$

~~$d = 0,114 \text{ \AA}$~~

~~$d = 0,114 \text{ \AA}$~~